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Association between Cord Serum Zinc and Some Obstetric Factors

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ABSTRACT

Zinc deficiency in neonates has been suggested to be related to poor growth, hyperbilirubinemia, seizures, necrotizing enterocolitis, retinopathy of prematurity and bronchopulmonary dysplasia by some investigators. The aim of this research was to determine the association between cord serum zinc and some obstetric factors. There was no significant association between some obstetric factors such as parity, maternal age, mode of delivery, antenatal visits and gestational age and cord blood serum zinc. The index study found that maternal parity had no statistically significant relationship with cord blood serum zinc.

Keywords:Association, cord, serum zinc and obstetric factors.

INTRODUCTION

There is dearth of published data on serum zinc level of neonates in Nigeria [1,2,3,4]. Normal zinc level is required by neonates for optimal growth and development; it is needed for optimal immune response, protein synthesis as well as synthesis and repair of DNA [5,6,7]. Zinc deficiency however has been suggested to be associated with most neonatal morbidities of which dermatitis is the most common [8,9,10]. Dermatitis due to zinc deficiency is in most cases mistaken for candida dermatitis, eczema or impetigo;in preterm neonates it usually presents in the anterior neck fold as poorly-marginated erythema [11,12]. Zinc deficiency has also been suggested to present as growth failure since zinc is required for cell division and optimal growth [13,14]. Zinc deficiency has also been suggested to be implicated in neonatal conditions like broncho pulmonary dysplasia, retinopathy of prematurity,seizures,hyperbilirubinemia and necrotizing enterocolitis (the most severe gastrointestinal emergency in neonates) [13,14,15]. Knowledge of serum zinc levels in such patients will aid in making a timely diagnosis and prevents waste of resources due to wrong or delayed diagnoses in managing these neonates especially as the economic indices of Nigeria are declining with subsequent difficulties in procuring zinc-rich foods [16,17].

MATERIALS AND METHODS

STUDY AREA

The study was carried out at the delivery room and Obstetrics theatre of FMC Owerri. The population of Imo state is about 3.93 million with about 401,873 people living in Owerri. Most of those living in Owerri are civil servants while traders and artisans constitute a small percentage of the population. The inhabitants of Owerri are predominantly of Igbo tribe. Federal Medical Centre Owerri is the foremost tertiary health institution in Imo state. It however provides primary, secondary and tertiary healthcare services in Paediatrics, Obstetrics and Gynaecology, Internal Medicine, and Surgery. It provides healthcare for patients from Imo state and parts of Abia, Anambra and Rivers states. The Paediatrics department is made up of the children's emergency, the children's ward, the children's outpatient department and the special care baby unit.The SCBU cares for sick neonates.It has two sections; the inborn and the out born units. The Obstetrics department conducts an average of 1500 deliveries yearly.The delivery room has 8 beds and is opposite the prenatal ward which has 12 beds while the Obstetrics theatre is situated between SCBU and the delivery room.

STUDY DESIGN

STUDY POPULATION

This consisted of neonates delivered at FMC Owerri within the study period and their respective mothers.

ETHICAL CONSIDERATION

Ethical approval for this proposal was obtained from the research and ethics committee of FMC Owerri.

INCLUSION CRITERIA

1 Neonates delivered at FMC Owerri within the study period.

2 Mothers who gave consent.

EXCLUSION CRITERIA

1 Neonates whose mothers were placed on zinc supplements during pregnancy

2 Neonates with gross congenital anomalies.

3 Neonates whose mothers had preeclampsia and eclampsia in pregnancy.

4 Neonates whose mothers suffered severe heart or lung diseases during pregnancy

INFORMED CONSENT

A written informed consent was obtained from the mothers once labour was established or as soon as she came in for caesarean section.The informed consent was obtainedafter providing information to parents regarding the study particularly benefits and risks involved in doing this study.

RECRUITMENT OF STUDY SUBJECTS

Mothers who met the inclusion criteria wererecruited as soon as labour was established oras soon as they came for caesarean section and a proforma was administered to her. This included her personal data, parity, socio-economic indices, nutrition while pregnant and medications taken while pregnant.All live neonates delivered in the labour ward and obstetrics theatre of FMC Owerri who met the inclusion criteria were consecutively recruited until the desired sample size was achieved. A quick general examination was carried out on the neonate before blood sample was collected from the umbilical cord. A more detailed examination was carried out on the neonate after sample collection. Warmth was provided using the resuscitaire for those that needed warmth.

SAMPLE SIZE ESTIMATION

The sample size for this study was calculated using the formula for calculating sample size when the study population is less than 10,000.

$$nf = \frac{n}{1+\left(\frac{n}{N}\right)}$$

nf=the desired sample size when population is less than 10,000
n=desired sample size when the population is more than 10,000.
N= the estimate of the population size

To calculate n, the formula $n = \frac{z^2 pq}{d^2}$

n=minimum sample size
z= normal standard deviation set at 1.96 which corresponds to the 95% confidence interval.
P= prevalence of zinc deficiency in Nigerian neonates. In this study,a prevalence of 39.6%
q= 1.0-p
d= degree of accuracy desired (considered significant at the 0.05 level).

Therefore n= $(1.96)^2$ (0.39) (0.61)/$(0.05)^2$
= 0.9139/0.0025
= 366

$$nf = \frac{366}{1+\left(\frac{366}{1500)}\right)}$$

$$= \frac{366}{1.244}$$

=294
Giving room for 10% attrition=29
Calculated sample size= 294+29= 323 neonates.
The respective mothers (323) of these neonates were also recruited and their serum zinc also assayed.

SAMPLING METHOD

The neonatesand their mothers were recruited consecutively until the desired sample size was attained.

STUDY PROCEDURE

The mother was counselled on the procedure and a written informed consent obtained from her. The study proforma was used to record the mother's biodata, parity, origin, address, phone contact. Other information recorded in the proforma includedmaternal intake of zinc-rich foods during pregnancy,number of antenatal visits and gestational age at delivery. Her height and weight were also measured and her HIV status wasalso recorded. Then 3millilitres of venous blood was collected from a prominent vein on the mother's upper limb after cleaning the area with a combination of 2% chlorhexidine and isopropyl alcohol. The sample was put in a pre-labelled sterile anticoagulant free bottle that had been immersed in 10% nitric acid and rinsed in deionized water to make it free from trace elements. Samples were transported in vaccine-rush containers with ice- gel packs (to prevent hemolysis of red cells) to the hematology department of FMC Owerri where samples were centrifuged for 10 minutes by the laboratory scientist and researcher. After centrifugation, the serum was separated from the cells with a bulb pipette and stored in a Thermocool® freezer at a temperature of -20◦c until enough samples were pooled for analysis. Upon delivery of the neonate and before delivery of the placenta, the cord wasdouble –clamped and the severed end (also known as the placental end) of the cord was cleaned with a sterile gauze to reduce contamination by wharton's jelly and maternal blood and was placed into the barrel of a 20 millilitres syringe and the clamp wasreleased to allow the flow of cord blood from the cord to the barrel of the syringe and the blood (3 millilitres) was subsequently transferred to the specimen bottle from the syringe. This was done after ensuring that the neonate did not have any gross congenital anomaly. The sample wasalso put into atrace- element decontaminated container, taken to the hematology laboratory for centrifugation and separation of serum from the blood cells, stored in Thermocool® freezer at -20°c same way with the mother's sample. Meanwhile the neonate was dried, provided with warmth on the resuscitaire (for those that needed it) and within this period, the neonate was examined mainly for the weight, length, occipitofrontal circumference; presence or absence of skin changes, palor and jaundice. The New Ballard scoring for preterm neonates was also done and the neonates were classified using the relationship between birth weight and gestational age on a standard growth chart (Colorado). All these measurements and examination findings were recorded in the study proforma. These samples (mothers' and neonates') that had been stored at -20°C were transported by road to the research laboratory at Nnamdi Azikiwe University Awka, Anambra Statein vaccine rush containers with ice gel packs. In the research laboratory, the samples were also stored at the same temperature of -20◦c before analysis.The researcher and the laboratory scientist analysed the samples using the Flame AAS machine. The serum was diluted five-fold with deionized water and passed through the Atomic Absorption Spectrophotometer; the diluted solution was compared against standards prepared to approximate viscosity in glycerol. The electrons of the atoms in the atomizer (a component of the AAS) were promoted to higher orbitals by absorbing a defined quantity of energy (radiation) in a process called atomization; the wavelength it travels corresponded to only one element giving the technique its elemental selectivity .The radiation flux with the standard was compared with that of the sample and the ratio between the two also known as the absorbance was converted to the concentration of the analyte(sample). The maternal serum zinc level was low when values below 49.9µg/dl are recorded while the cord serum zinc level was said to be low when values less than 64.7µg\dl are recorded. The cord blood serum zinc level of the neonate and serum zinc level of the mother were

recorded in the proforma. The mothers of the zinc- deficient neonates were contacted to bring their neonates to the neonatology follow-up clinic for treatment;the zinc-deficient mothers were also contacted and referred to the gastroenterology clinic for treatment.

QUALITY CONTROL

Samples were collected from the cord immediately the umbilical cord was severed. These samples were centrifuged at the FMC Owerri laboratory, separated with a bulb pipette and then stored in the Thermocool® freezer at -20 degrees Celsius. This was ensured by keeping a dedicated freezer under lock and key at one end of the SCBU call room which had a constant light supplyto power the incubators. These stored samples were transported to Awka in ice pack using a private vehicle inorder to shorten the time spent on the road thereby avoiding temperature alterations. At the laboratory the samples were also transferred into a freezer for storage before analysis. Before analyzing the samples, standards were prepared and were run at intervals to ensure similar results were obtained.

DATA ANALYSIS

Data was analysed using Statistical Package for Social Sciences (SPSS) version 20.0. Descriptive analysis such as mean and standard deviation were calculated for continuous variables like cord serum zinc levels; frequency distribution tables and percentages were used for variables like gender and mode of delivery of neonate whilebar chart was used to demonstrate the relationship between categories ofgestational age, birth weight and cord serum zinc. Chi-Square wasused to determine association between categorical variables like association between cord serum zinc and gender whilePearson's Correlation was used to test for strength and direction of association between cord serum zinc and maternal serum zinc; p-value ≤ 0.05 was regarded significant.

ASSOCIATION BETWEEN CORD SERUM ZINC AND SOME OBSTETRIC FACTORS

Table 1 shows no significant association between parity, maternal age, mode of delivery, Antenatal Care (ANC) visits and gestational age and cord serum zinc level p-values 0.85, 0.51, 0.57, 0.11, and 0.21respectively.

Table 1 Association between some obstetric factors and cord serum zinc level

Obstetric Factors	Cord Serum Zinc (n/%)		Total	$\chi 2$	p-value
	Low	Normal			
Parity					
Primipara	54 (46.6)	62 (53.4)	116		
2 – 4 children	88 (50.6)	86 (49.4)	174	0.336	0.85
>5 children	18 (45.0)	22 (55.0)	40		
Total	160 (48.5)	170 (51.5)	330		
Maternal Age(years)					
19 – 35	136 (49.6)	138 (50.4)	274		
> 35	12 (42.9)	16 (57.1)	56	0.43	0.51
Total	160 (48.5)	170 (51.5)	330		
Mode of delivery					
SVD	142 (49.3)	146 (50.7)	288		
CS	14 (38.9)	22 (61.1)	36	1.11[¥]	0.57
Vacuum	4 (66.7)	2 (33.3)	6		
Total	160 (48.5)	170 (51.5)	330		
ANC Visits					
<4	8 (28.6)	20 (71.4)	28	2.58	0.11
≥4	150 (51.0	142 (49.0)	294		
Total	158 (49.1)	164 (50.9)	322		
Gestational Age					
Below 37 weeks	10 (55.6)	8 (44.4)	9		
37 – 42 Weeks	146 (47.4)	162 (52.6)	302	3.15[¥]	0.21
Above 42 weeks	2 (100)	0	2		
Total	160 (48.5)	170 (51.5)	330		

Likelihood Ratio

DISCUSSION

There was no significant association between some obstetric factors such as parity, maternal age, mode of delivery, antenatal visits and gestational age and cord blood serum zinc.The index study found that maternal parity had no statistically significant relationship with cord blood serum zinc. This finding is supported by [18,19,20] found a statistically significant relationship between parity and cord plasma zinc. The findings documented by [21] can be explained by the fact that they excluded mothers who took alcohol, illicit drugs, smoked tobacco, had trauma or any other form of abuse and who were under severe stress as against the present study where these group of mothers were not excluded. The result documented by the Croatian investigators may have arisen from the fact that the research was carried out in a region with different geographical indices from this study.

CONCLUSION

In conclusion, the result from this research found no significant association between some obstetric factors such as parity, maternal age, mode of delivery, antenatal visits, gestational age and cord blood serum zinc.

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